Archives
S
71
.E
1916/17-
1925/26

LIBRARY—COLLEGE PARK

MARYLAND & RARE BOOK ROOM
UNIVERSITY OF MARYLAND LIBRARY
COLLEGE PARK, MD.

Digitized by the Internet Archive
in 2015

https://archive.org/details/annualreportofma30mary

The Thirtieth Annual Report

of the

Maryland State College of Agriculture

Maryland

Agricultural Experiment Station

College Park, Prince George County, Maryland

Archives
UPUB
A33.001

1916-1917

Published by the Station

The Maryland Agricultural Experiment Station

CORPORATION

The Board of Trustees of the Maryland State College of Agriculture

Samuel M. Shoemaker (Chairman)	Eccleston.
B. John Black	Roslyn.
Robert Crain	Tompkinsville
John M. Dennis	Riderwood.
Frank J. Goodnow	Baltimore.
Carl R. Gray	Baltimore.
Henry Holzapfel, Jr	Hagerstown.
Alrert W. Sisk	Preston.
W. W. Skinner	Kensington.

STATION OFFICERS AND STAFF.

Harry J. Patterson	*Director and Chemistry.*
J. B. S. Norton	*Botany and Plant Pathology.*
E. H. Brinkley	*Farm Superintendent.*
Thos. H. White	*Vegetable and Floriculture.*
Chas. O. Appleman	*Plant Physiology.*
Roy H. Waite	*Poultry.*
C. P. Smith	*Seed Inspector.*
W. R. Ballard	*Pomology and Small Fruits.*
C. L. Opperman	*Supt. Ridgely Farm.*
E. N. Cory	*Entomology.*
A. G. McCall	*Soils.*
R. L. Hill	*Biochemistry.*
J. E. Metzger	*Agronomy.*
S. Edw. Isacson	*Animal Pathology.*
E. S. Johnston	*Associate, Stone Fruits.*
R. S. Allen	*Assistant, Animal Husbandry.*
Paul Emerson	*Soil Bacteriology.*
P. E. Richards	*Assistant, Soils.*
R. C. Towles	*Secretary.*
S. W. Phillips	*Assistant, Soils.*
J. M. Arthur	*Assistant, Plant Physiology.*
P. Garman	*Assistant, Entomology.*
V. R. Pfingstag	*Assistant, Soils.*
C. E. Leathers	*Assistant, Botany.*
Miss L. E. Conner	*Librarian.*
A. C. Keefer	*Clerk.*

The Station is located on the B. & O. R. R. and City and Suburban Electric Car Line, eight miles north of Washington, D. C.

Bell Telephone—Berwyn Exchange.

Visitors will be welcomed at all times, and will be given every opportunity to inspect the work of the Station in all its departments.

The Bulletins and Reports of the Station will be mailed regularly, free of charge, to all residents of the State who request it.

ADDRESS:
AGRICULTURAL EXPERIMENT STATION,
College Park, Md.

Jo^c

Letter of Transmittal

To His Excellency, E. C. Harrington, Governor,
Annapolis, Maryland.

Sir:—In accordance with the provisions of Section No. 3 of the Act of Congress, approved March 2, 1887, "To Establish Agricultural Experiment Stations," etc., I have the honor to transmit the Thirtieth Annual Report of the Maryland Experiment Station for the fiscal year ending June 30, 1917.

Very respectfully yours,

H. J. PATTERSON,
Director of the Experiment Station.

June, 1917.

162385

Thirtieth Annual Report

of the

Maryland Agricultural Experiment Station

CONTENTS.

Page.

Board of Trustees and Station Staff ii
Letter of Transmittal iii
Director's Report v
Publications v
Changes in Staff vi
Investigations in Progress vii
Botany and Plant Pathology vii
Plant Physiology viii
Vegetables and Flowers ix
Pomological and Small Fruit Investigations x
Stone Fruit Investigations xii
Entomology xiii
Soil Fertility Investigations xvi
Poultry xvii
Biochemical (Milk) Investigations xviii
Tobacco Investigations xix
Ridgely Sub-Station xx
Seed Inspection xxiii
Biological Laboratory xxiv
Finances xxvi
Bulletin No. 197: Clover and Grass Seed Inspected in 1914.. 1
Bulletin No. 198: Wheat 59
Bulletin No. 199: Tests of the Value of Stable Manure, Commercial Fertilizers and Crimson Clover for Vegetable Crops 95
Bulletin No. 200: Winter Oats, Barley, Spelt and Emmer.... 107
Bulletin No. 201: Soybeans 131
Bulletin No. 202: Timothy Fertilization and Culture........ 159
Bulletin No. 203: Agricultural Seed Inspected in 1915...... 179
Bulletin No. 204: Variety Tests of Potatoes, Tomatoes, Cabbages and Other Vegetables........ 231
Bulletin No. 205: Fumigation of Greenhouses 263
Bulletin No. 206: The Hothouse Milliped 283
Bulletin No. 207: Plum Growing in Maryland........ 295
Bulletin No. 208: *Tarsonemus Pallidus* Banks, a Pest of Geraniums 327
Index 343

THE MARYLAND AGRICULTURAL
EXPERIMENT STATION

Volume 30. 1916-1917.

The Thirtieth Annual Report of the Maryland Agricultural Experiment Station

FOR THE FISCAL YEAR ENDING JUNE 30, 1917.

By H. J. PATTERSON, Director.

To the Board of Trustees:

GENTLEMEN:—I have the honor to submit the following summary of the work of the Experiment Station for the past fiscal year.

PUBLICATIONS.

During the past year a larger number of experiments than usual had progressed far enough to warrant the publishing of the results to date. These bulletins give, in the main, a statement of the history and progress of the investigations being conducted.

The bulletins are sent free to all farmers in this State who desire them and also to all the newspapers in Maryland. The Station's mailing list includes most of the agricultural periodicals in the United States and the principal libraries of the world.

The following bulletins were issued during this fiscal year:

Date	No.	Subject	Author
July 1916	197	Clover and Grass Seed Inspected in 1914..........	C. P. Smith
Oct. 1916	198	Wheat	N. Schmitz
Dec. 1916	199	Tests of Stable Manure, Commercial Fertilizers and Crimson Clover for Vegetable Crops	Thomas H. White
Jan. 1917	200	Winter Oats, Barley, Spelt and Emmer	N. Schmitz

Feb. 1917	201	Soybeans	N. Schmitz
Feb. 1917	202	Timothy Fertilization and Culture	N. Schmitz
Mar. 1917	203	Agricultural Seed Inspected in 1915................	C. P. Smith
Mar.....1917	204	Variety Tests of Potatoes, Tomatoes, Cabbage and Other Vegetables.........	Thos. H. White
April ...1917	205	Fumigation of Greenhouses.	E. N. Cory
April ...1917	206	The Hothouse Milliped.....	E. N. Cory
May.....1917	207	Plum Growing in Maryland.	F. S. Holmes
June 1917	208	Tarsonemus Pallidus Banks, a Pest of Geraniums.....	Philip Garman
June 1917		30th Annual Report........	H. J. Patterson

A total of 12 bulletins containing 342 pages.

CHANGES IN STAFF.

The following changes were made in the Station staff during the year:

Dr. S. S. Buckley was transferred from the Biological Laboratory to animal husbandry work in the Extension Service.

F. T. Kocher, D. V. S., a graduate of the University of Pennsylvania, succeeded Dr. Buckley as Animal Pathologist until May 1917; when he resigned to take up private practice, and this vacancy was filled by the appointment of S. Edw. Isacson, D. V. S., a graduate of the University of Pennsylvania.

N. Schmitz resigned his position as agronomist to accept a position on the Extension Staff of the Pennsylvania State College. This place was filled by the appointment of J. E. Metzger, B. S., who had been professor of agricultural education in the College for three years.

F. S. Holmes resigned to accept a commission in the National Army, and this vacancy was filled by the appointment of Earl S. Johnston, Ph. D., of Johns Hopkins University.

The Adams fund entomological investigations were provided for by the appointment of Philip Garman, Ph. D., of the University of Illinois.

The soil investigations which were provided for by the Legislature of 1914, but the money not being available, work was not started until 1916. A. G. McCall, Ph. D., of the Ohio State University, was appointed leader in this work. Paul Emerson, Ph. D., Iowa State College, was appointed Soil Bacteriologist; P. E. Richards, M. S., Ohio State University, was appointed laboratory assistant and S. W. Phillips, M. S., Ohio State University, field assistant in the soil investigations.

J. M. Arthur, of Chicago University, was appointed assistant in the Plant Physiology Department.

D. G. Sullins, M. S., of Missouri University, was appointed to animal husbandry investigations in meat production.

K. C. Cole resigned his position as assistant agronomist to enlist in the Army.

INVESTIGATIONS IN PROGRESS.

Botany and Plant Pathology.

J. B. S. Norton.

ADAMS FUND PROJECTS.

Project 1. Tomato Blight. Since last spring the greater part of the time of this department has been given to this project, in studying the life history of the Septoria which causes it, on different culture media and on different relatives of the tomato in field and greenhouse and on over 100 varieties of tomatoes. A paper on its variation on different hosts was read at the New York meeting of the American Phytopathological Society in December.

A study of the relation of infection by this fungus to different environmental conditions was made and reported on in a paper before the Botanical Society of America in New York in December.

Further work is contemplated on this project: 1. To determine the amount and character of injury in different degrees of infection with the blight. 2. Temperature relations of infection. 3. Infecting tomatoes grown in sterile vessels to determine accurately the later stages of the fungus.

Control investigations for this disease have been taken up by Professor Temple in cooperation with the United States Department of Agriculture.

Project 2. The effect of chemicals acting through the root on resistance of tomatoes to disease. The results of this investigation were published in January 1916, but further and more accurate work along this line is now being continued with copper sulfate under Project 1 with the tomato blight fungus.

Project 3. Effect of sulfur on the cell structure. Active work on this subject has been pursued since November by Mr. W. P. Snyder, research fellow. We have thoroughly outlined the plans, secured materials and the preliminary cultures of soybeans and mustard are now being grown with the sealed pot method in the greenhouse. The methods used in this work are similar to those used by Dr. McCall, and we have had the opportunity to make such ready use of them through the cooperation and advice of Dr. McCall and Mr. Richards. The material is about ready for sectioning and study, but further work on this will be much hindered by Mr. Snyder's leaving for a position in the United States Department of Agriculture.

Project 4. Brown rot. For lack of material to work on last year and the need of time for other projects, this one has received but little attention the past year. The entire absence of peaches last year and their abundance the previous year in our orchards, gives excellent conditions now for determining the relation of the two-year-old mummies to the blossom blight. The abundance of the spring stage of the brown rot fungus now appearing and the recent frost injuries to fruit buds give promise of a bad outbreak of the blossom blight if warm moist weather should occur.

OTHER INVESTIGATIONS.

Project 5. Fursarium wilt resistant tomatoes. The selection and purifying of strains formerly secured has been continued and is to be further continued this year. Stock of seed developed last year has been turned over to the Extension workers and to various farmers, Experiment Station workers in other States and to the United States Department of Agriculture. The latter grew an acre of seed stock of one of our best strains last year and is using this stock for testing on tomato farms in Maryland, Delaware and New Jersey.

Project 6. Plant disease survey. This has been carried on as usual in cooperation with the United States Department of Agriculture. A considerable part of the time not devoted to Adams Fund work has been taken by the identification of fungi, diseases, weeds, and other plants for correspondents of the Station and for other members of the staff.

Project 7. Maryland grasses. No further progress made since the last report.

Plant Physiology.

C. O. Appleman.

The most important results obtained during the past year were in connection with the discovery of a very remarkable controlling influence of ventilation on the shifting of the equilibrium positions of reversible carbohydrate reactions in potato tubers. The direct effect of ventilation seems to be attributable to the active removal of the carbon dioxide produced in the tissues by respiration. These results are not only of considerable scientific interest but also promise important application in some of our practical storage problems. A preliminary report of this work was presented before the physiological section of the Botanical Society of America at the New York meeting of the current year.

A bulletin on spindling sprout has not been issued because of the important results which are being obtained from other projects on carbohydrate transformations in potato tubers. These results may throw some light on the abnormal carbohydrate metabolism in the diseased tubers.

The following is a list of the active projects in this department and the problems in connection with the same, that have been worked upon during the past year:

(1.) Biochemical and physiological studies on the rest period of potato tubers.
  (a) Measurements of hydrogen *ion* concentration in cell sap at frequent intervals during the entire rest period.
  (b.) More detailed study of the controlling influence of gas environment on the rest period with special reference to carbon dioxide and oxygen ratios.

(2.) "Spindling-sprout" disease of the potato tuber.
  (a.) Pathological physiology of the diseased tubers.
  (b.) Analysis of the environic complex responsible for the pathological conditions.

(3.) Metabolism studies in potato tubers.
  (a.) Relation of external factors to the shifting of equilibrium positions in reversible carbohydrate reactions.
  (b.) On sugar content and respiration.
  (c.) The controlling influence of carbon dioxide on sprouting of potato tubers.

(4.) Laws and mechanism of inhibition and correlations in the growth of buds on the potato tuber.

New Projects.

(1.) Respiration and carbohydrate transformations in sweet corn.
(2.) The controlling influence of ventilation on metabolism in storage organs, with special reference to carbon dioxide in the surrounding atmosphere.
  (a.) Carbohydrate transformations.
  (b.) Respiration, aerobic and anaerobic.

Vegetables and Flowers.

Thomas H. White.

The following is a list of the projects and work on hand in Olericulture and Floriculture:

Project 1. The effect of fertilizers on plant variation.
Project 2. Fertilizers in the greenhouse.
Project 3. Seed saving for adaptation, disease resistance, etc.
Project 4. Relation of seed pods of ten-week stalks (Mathiola Inicana Amnua) as related to doubling.

Project 5. Improvement of McCormick potato by hill selection and otherwise.
Project 6. What amount of fertilizers and manures is it necessary to apply to keep soils fertile for truck crops?
Project 7. Testing vegetable novelties.
Project 8. Stable manure rotted and fresh versus commercial fertilizers for truck crops.
Project 9. Best method of using crimson clover when sown as a fertilizer for tomatoes.
Project 10. Permanent plots for sweet potatoes.
Project 11. Inheritance of the climbing habit in pole Lima beans.
Project 12. Hand versus natural pollination of greenhouse tomatoes and its relation to the yields of varieties.
Project 13. Breeding and selection tests with tomatoes which aims to improve the shape and quality of canning tomatoes.
Project 14. A study of the fertilizer requirements of asparagus.
Project 15. Testing the value of rye turned down green as a fertilizer for truck crops.
Project 16. Suitability of Garrett County climate for the production of cool climate vegetables.

In addition to these projects there is considerable preliminary work in progress which aims to give definite data to base new investigations upon.

Pomological and Small Fruit Investigations.

W. R. Ballard.

Project 1. Data was secured on the comparative yields of the varieties of grapes used in the trellis and training systems experiment. The growth of the vines on one side has been interfered with to some extent by some large apple trees growing near and it has been necessary to remove these trees. Mildew has injured some varieties so that it has been difficult to follow out the training systems as well as has been desired.

Project 2. Some of the varieties of the Vinifera type of grapes have made very poor growth and some have died outright. Those making satisfactory growth are Muscat-Albardiens, Chasselas Dore, Frankenthaler, Rozaki, Burger, Damascus, Mission, Chasselas Rose Royale, and Jura Muscat.

Project 3. The Delaware grape grafted on the various stocks has made a good growth in all cases.

Project 4. On account of the rush of spring work at the blooming season last spring it was impossible to get much cross-pollination work done with grapes, but considerable work has been outlined for the coming season.

Many of the seedlings of the 1915 crosses have made sufficient growth so that a considerable number should fruit this season. The Clinton seems to have a dominating influence in transmitting its vigor and hardiness to its offspring. Even seedlings of crosses with the tender Vinifera types seem to stand our winter conditions without protection. Resistance to mildew has been fairly well marked but considerable injury from leaf hoppers has been noted. Detailed descriptive notes of these seedlings are being made.

Project 5. The past season has been quite favorable for the development of the strawberry crop. The rains have been sufficient and well distributed and the mean temperature has been a little lower than usual. Some of the varieties which give poor results in ordinary seasons have given unusually good crops of fancy fruit. Manuscript is being prepared for a bulletin giving the results of tests of a number of varieties.

Project 6. The old plantings of currants and gooseberries have outlived their usefulness and have been removed. Some varieties of blackberries are still giving good yields, but others have suffered from rust, double blossom disease and winter injury. A part of the old orchard has been plowed up and will be planted to some vegetable crops after which it will be used for starting a new planting of blackberries and dewberries.

Project 7. The quince orchard has suffered severely from attacks of blight, some varieties having been killed outright.

Project 8. It has been impossible to accomplish much during the past season in the production of apple stocks because of a lack of material for breeding purposes. When pollen can again be secured from the Doucin stock, it is hoped that this work may be continued.

Project 9. Notes and observations have been made on new varieties of apples as they have come into fruit.

Project 10. Over 200 seedling apples were in fruit the past season. Of these fifteen or more are promising early sorts. These have been propagated and will be given a careful test under orchard conditions to determine their commercial value.

Project 11. A very limited number of the pear seedlings have fruited to date. From last year's crosses a number of seedlings have been secured and these will be added to the present plantings when they attain sufficient size.

Project 12. Geranium varieties of the Nutt and Ricard type seem to be most resistant to diseases, but they are inclined to be more sterile than some other types so that it has been difficult to get viable seed in quantity. Progress has, therefore, been slow on this account. About forty seedlings were in bloom this season for the first time but none of them showed any special merit.

Project 13. It has been necessary to reorganize the work with strawberries at the Ridgely sub-station. The size of the plots has been reduced in order to avoid too great a variation in the soil conditions and also to provide for a three-year rotation. The high price of potash has made it seem desirable to cut down the percentage of this element in the fertilizer for the fertilizer plots. The variety in the plots has been changed from Senator Dunlap to Superior, a variety better adapted to canning purposes. The size of the plots in the variety test have been reduced in order to accommodate more varieties.

Project 14. This is a new project outlined to study the histology, morphology and physiology of the development of Diospyros virginiana and Asimina triloba. Material for this study will be collected during the spring and summer months and worked up during the winter when the field work is not pressing.

The usual notes have been taken on the blooming and ripening periods of the various fruits.

Stone Fruit Investigations.

F. S. Holmes.

Data of various kinds regarding nut culture in the State which has accumulated since the publication of Bulletin Number 125 has been coordinated and summarized. This data shows that the number of persons known to have Persian walnut and pecan trees is three times as great as the number reported in Bulletin 125. When reports upon the present condition of the large number of trees sent out by the Station in 1907, 1908 and 1909 are secured at the end of the present growing season there will be enough material available for a bulletin on the general subject of nut culture if it is thought advisable to publish it.

An abundance of rainfall and good cultural care throughout the growing season induced a better growth of the Persian walnuts and the pecans on the Station grounds than was the case in any previous season. At the time these trees were planted very few of what are now considered the more hardy varieties of either were upon the market.

All the more hardy varieties of both were planted this spring. The Station collection now includes all the varieties upon the market which give promise of succeeding under our climatic conditions. Several of the more promising varieties of the black walnut have been planted also.

The variety plum orchard, with the exception of a few trees, having outlived its usefulness has been removed. The knowledge of the behavior of the varieties composing this orchard and an estimate of their values for culture in Maryland are embodied in the bulletin on ''Plum Growing in Maryland.''

While is is unlikely that there will be a ''boom'' in plum growing in the near future, as we had fifteen or twenty years ago, there are a number of new varieties which will be widely advertised regardless of their value here. As there is no other agency for testing such varieties, it may be advisable for the Station to plant another variety orchard. If planted this orchard should also include some of the well-known European varieties which were not grown in the old orchards.

Notes upon the behavior of the peaches and the cherries in the variety collections have been secured as in former years. On account of the severe cold the preceding winter there was practically no crop of fruit last season, however.

The fertilizer and cultivation treatments for the McNamee peach orchard were carried out the past season. No marked differences as a result of the different treatments are apparent as yet, though it is too soon to expect results of a definite nature. These treatments will be continued this season. Blooming, growth and production data are being collected again this season.

Entomology.

E. N. Cory and Philip Garman.

ADAMS FUND PROJECTS.

Project 6. Biology of Tarsonemus pallidus and its relation to the transmission of certain diseases of bedding plants.

The biology of Tarsonemus pallidus has been completed and published in Bulletin 208. Its control has not been fully worked out nor has its relation to the transmission of diseases been definitely ascertained.

The mite proved to be parthenogenetic, producing females from the unfertilized eggs. The length of all stages, the relation of temperature and moisture to development and the habits of both males and females have been ascertained.

The leaf spot disease is caused by *Botrytris cinerca* and may be transmitted by Tarsonemus. The pustular spot or stigmanose is due to mechanical irritation of the tissues when fed upon by mites and is simply hypertrophy of the cells. This can be caused by the red spider, Tetranychus telarius, but cannot be produced by Tarsonemus pallidus. Instead the latter produces a distinct scorching due to removal of epidermis. This is followed frequently by chlorosis.

NEW PROJECTS.

Project 11. Biology and control of Laspeyresia molesta Busck. A new peach pest, undoubtedly introduced from Japan, has gained a foothold at College and elsewhere in the State and District of Columbia. It probably came to this State from the District of Columbia.

This pest enters the terminal shoots and the green fruits. The former habit is not necessarily of grave import but the latter habit means a great annual loss unless effective control measures can be divised.

HATCH FUND WORK.

Project 8. Practical tests of maggot traps. The most important project completed was one in cooperation with the United States Bureau of Entomology on the control of house flies by the maggot trap method. This project has been under investigation for three years. The first year's results have been published by the Bureau of Entomology in their Bulletin No. 200. The last two year's work will be published separately by the cooperating parties.

In brief, the maggot traps, three in number, two of which have been in operation only two years, have reduced the potential number of flies by the capture of 6,879,271 maggots. The actual reduction of flies could not be ascertained, but the relative reduction as shown by counts of flies caught on fly paper and in traps at three stations on the College grounds was very noticeable during the months of June, July, August and September.

Not only have the flies been reduced on the College and Station grounds, but a householder adjacent to the Station grounds reports that comparatively few flies were around after the traps were put in operation, whereas previously the flies were so abundant as to be almost unbearable. The cost of operating the traps adds slightly to the usual cost of handling manure. The initial cost of the traps is approximately $40.00 each. Full details in regard to this project will be given in the bulletin which will be issued on this subject.

P*roject 1. Control of the Woolly Aphis of the Apple.*

The past summer records were made on the results of the first year's spraying of the roots and crowns of nursery stock infested with the Woolly Aphis.

Pine tar cresote emulsion in 5, 8, 15 and 20% strengths was applied once and twice on different plots.

The trees were dug December 8, 1916, and the results were most encouraging. Two applications of 8% emulsion gave complete control of the aphids.

The work has two years yet to run.

Project 7. Biology and Control of Some Greenhouse Pests. This project has been divided into several parts; that on fumigation and the Hothouse Milliped having been published.

Work on red spider and mealy bug control is being continued with promise of success.

Project 9. Comparative Insecticide Tests. This project is of such inclusive nature that conclusions must be reported in parts.

The cabbage spraying and dusting tests showed an increase of 25%

in production for the plants treated three times over those treated once. Spraying produced larger crops than dusting. However, the latter is the least expensive. Dusting three times showed a 50% increase over dusting once. Dusting with powdered arsenate of lead or lime or arsenite of zinc plus air-slaked lime twice per season or possibly three times in wet seasons is recommended. This part of the project is reported in the current report of the Maryland State Horticultural Society.

Project 10. Repelling Stable Flies. This project was begun with the cooperation of Mr. R. H. Ruffner, who has extended valuable help and suggestions.

The first phase, that of determining the minimum effective strength of pine tar-cresote emulsion and the best spraying procedure in repelling stable flies from cattle has been completed and reported in the Journal of Economic Entomology, Vol. 10, No. 1, pp. 111-114, incl., under the title of "Protection of Dairy Cattle from Flies."

The second phase, that of determining the increase in milk production by fly-free cattle will be continued this summer on farrow cattle as a decided increase was obtained in the limited tests last summer.

Project 15. Biology and Control of Dasyneurarhodophaga Coq. This project was entered upon in cooperation with the Bureau of Entomology, E. R. Sasser, collaborator, last fall and control measures devised by this department were prosecuted with considerable success. The life history is being worked out at this Station.

Project 12. An Annotated List of the Halticini of College Park and Vicinity. This project was started as a thesis for the graduation of Mr. A. B. Duckett. The work has been continued by Mr. Duckett since his employment in the Bureau of Entomology.

The flea beetles of the College collection have been determined, 48 species being listed and extensive notes and bibliographical references collected.

Project 13. Winter Protection for Bees in Maryland. This project is of paramount importance to the Maryland beekeeper and at the same time fits in very well with plans being made to keep the bees from being disturbed by intruders during the winter.

Project 14. A Simple Method of Successfully Maintaining Bees from Season to Season for the Work of Cross Pollination of Greenhouse Crops. This project will be undertaken at the request of Professor Stoddard, who wishes to have a colony of bees in the cucumber house. In order that we may learn some facts of value, we have agreed to handle the bees and Mr. Stoddard has agreed to follow a definite system of cropping.

Project 16. Biology and Control of Canarsia hammondi Riley. This insect, the apple leaf skeletonizer, has been a nursery pest of major importance for the past two seasons. The investigation will constitute the major work of Mr. McConnell for his master's degree.

Soil Fertility Investigations.

A. G. McCall.

The special work in soil fertility was inaugurated as a result of the special appropriation made in 1914. The money appropriated under this act was not available until 1916. After making a study of the problems to be taken up, it was decided to plan the work and expenditures to cover a period of five or six years and thus insure some results rather than to map out the investigations on a larger scale without the assurance of having enough funds to carry them far enough to get something definite.

Since the establishment of this department several lines of soil investigations have been inaugurated and considerable time devoted to the organization of the work to be carried out under the Adams Act Funds and under the provisions of the State Act of 1914. In addition to the new lines of work the department has assumed charge of the triangular soil exchange plots which were started eight years ago in cooperation with the United States Department of Agriculture, and of the green manuring projects which were started by the Department of Agronomy in 1914 on the Scaggs and on the McNamee farms.

Adams Fund Projects.

Project 1. An Investigation of the Food Requirements of Plants Growing in Sand or Soil Cultures. In the study of soil and fertilizer problems, the agronomist is constantly in need of a better understanding of the physiological requirements of the plants with which he is dealing. It is the purpose of the present study to determine the best proportion of the essential mineral salts for the optimum growth of several plant groups that are of agricultural importance. Data has been secured for the early growth periods of both the wheat and the soybean plant. Three papers upon this subject have been prepared during the year, the first of which appeared in soil science. The second paper was read at the annual meeting of the Society for the Promotion of Agricultural Science at Washington, while the third paper was presented at the New York meeting of the Botanical Society of America, December, 1916.

Project 2. A Study of the Hourly and Daily Fluctuation in the Temperature of the Soil. This project is intended to supplement the soil bacteriological work of this department and the pathological investigations of the departments of plant physiology and plant pathology by furnishing data concerning one of the important environmental factors influencing bacterial changes and the activities of pathogenic organisms in the soil. Three double-pen thermographs are being installed for recording the temperature changes at two different depths under both sod and cultivated surfaces.

Project 3. The Effect of Leguminous and Non-Leguminous Green Manure Crops upon the Activities of Microorganisms in the Soil. Under this project it is proposed to correlate the yields and the chemical changes in certain of the green manuring plots with the bacteriological conditions within the soil.

STATE SOIL FUND.

For the purpose of carrying out the intent of the State Act of 1914 the department is investigating, by means of chemical analyses and field plot experiments, the fertility of the important soil types of the State. At the Ridgely sub-station farm 140 plots of 1-40 acre each and 10 plots, 1-25 acre each, are now under treatment. In St. Mary's County a ten-acre tract of typical Leonardtown silt loam on the Almshouse Farm has been secured and is now under investigation. The St. Mary's County tract has been leased for a period of five years with the privilege of renewal for a second five-year period. This long-term lease will enable us to carry our treatment over two complete rotations and thus secure results that will be of direct practical value in the management of this soil type not only in this county but throughout the State. This field plot work will be extended to other important soil types as rapidly as our funds permit. As a supplement to the field plot work, pot cultures are being conducted in the greenhouse during the winter months. During the growing season the pot work will be continued in the open.

Green Manuring Experiments.

This work is being continued substantially as originally outlined by the Department of Agronomy, but the study has been extended to include the effect of the green manure crops upon the chemical composition and the bacterial flora of the soil as well as the effect of the treatment upon the crop yields. The chemical study will be confined primarily to the effect of the treatments upon the availability of the mineral elements while the bacteriological work will be concerned chiefly with the nitrogen transformations taking place within the soil and the effect of those changes upon the growth of crops.

Poultry.

R. H. Waite.

The investigations outlined in the twenty-eighth annual report were continued. Some results from these investigations will be available by the end of this season.

Biochemical (Milk) Investigations.

R. L. Hill.

Two Adams Fund projects have been outlined and preliminary work commenced. Considerable delay has resulted from our inability to obtain materials necessary for the work without much loss of time.

Project 1. An Investigation of the Food Value for Infants and Invalids of Various Milks. This project was begun by Dr. S. S. Buckley, who has published a preliminary report of his investigation in Bulletin No. 184.

A problem that sometimes confronts most every family is the problem of finding an adequate and digestible food for some member of the family, usually an infant or invalid. Milk has been the food that has usually been chosen, but considerable difficulty has here been experienced due to the fact that some individuals, and particularly infants and invalids, are incapable of properly digesting and assimilating ordinary milk unless it is modified in some way to alter its physical character. There are many commercial preparations on the market for use in modifying milk. Also many eminent physicians have given formulas for the modification of cow's milk to make it an adequate substitute for "mothers milk." In spite of the studies along this line many children have died in infancy and others developed weak bodies due to lack of proper nourishment in the most important growing periods of "babyhood." This project was outlined with the object in view of studying and determining, if possible, the reason for the great difference in the digestibility of various milks. Also to compare the milks obtained from different breeds of cattle and individuals within the breed; to see if the production of milk capable of easy or difficult digestion is a breed or an individual characteristic. To develop if possible a test that can be quickly and accurately applied to milks in determining their value as an infant or invalid food.

The results so far obtained in this project have been very interesting but it is not deemed advisable to publish them at present.

Project 2. An Experimental Investigation of the Physiological and Chemical Changes Taking Place in the Mammary Gland During Milk Secretion. Our present knowledge of the changes taking place in the mammary glands during milk secretion are very meager and we have only theoretical postulations to account for the secretion of the various constituents of the milk. It has, therefore, been deemed advisable to investigate this point further.

The work on this problem has been only of a preliminary nature and has consisted largely of studies to develop the best method of attack and preparations for the analytical work involved.

It is planned for the coming year to commence investigations on this project in connection with Project No. 1 and to utilize several animals for this purpose.

Tobacco.

In cooperation with the United States Department of Agriculture.

W. W. Garner and D. E. Brown.

This work is conducted at Upper Marlboro on land which is rented for that purpose.

The following is a brief summary of the present status of the work. Data as to weights of tobacco from the plots for 1916 are not yet available, of course, so that our latest final results are only for 1915. The yields of tobacco in general in 1915 were poor on account of unfavorable seasonal conditions, while in 1916 it was evident that much larger yields were obtained on the whole.

In the regular fertilizer tests with tobacco the application of nitrogen in inorganic forms increased the yield as much as 50 per cent, while the organic forms gave increases averaging about 30 per cent. The most striking feature was the exceptionally poor showing made by cottonseed meal. In testing the relative values of different forms of phosphorus, the results were inconclusive, for little response was obtained from any phosphorus application. This is apparently due, however, to the fact that cottonseed meal was used as a source of nitrogen in this series of plots. In the set of special potash plots applications of 12, 24, and 36 pounds of potash gave increases in yield of 20 to 35 per cent, indicating that while large applications of potash are unnecessary on the soils of Southern Maryland, light applications of this element may give profitable returns with tobacco. Last year a new set of plots, receiving nitrate of soda and dried blood in three different rates of application, gave some very striking results, although the data on yields are not yet available. The striking feature was that even the smallest application of nitrate of soda gave distinctly inferior colors in the cured leaf as compared with the several applications of dried blood.

During the last two or three years we have been obtaining excellent crops of red clover, vetch and cowpeas on the rotation plots and usually good crops of crimson clover. In spite of this fact the yields of tobacco in 1915 were low in all cases. The yields in 1916 undoubtedly will be much better, but, nevertheless, the growth of the tobacco is not in proportion to the heavy growth of legumes, most of which is being turned under. The behavior of the tobacco on these plots has led to the discovery that on at least a considerable proportion of the tobacco soils in Southern Maryland there is a parasitic disease attacking both tobacco and the legumes which we are using on the plots. The symptoms of the disease above ground are very similar to those of tobacco root rot and the indications are that the Maryland disease is the same as one which has been giving much trouble in New England and elsewhere. We are now making a thorough study of the disease in Maryland and are confident that we will soon obtain some important results. This disease explains the unevenness of

162385

growth in tobacco and the long delay in starting off after transplanting frequently observed in the tobacco crop. All varieties of Maryland tobacco, including the Mammoth, appear to be susceptible to the disease, while the Connecticut Broadleaf is practically immune. We have discovered on the farm of Mr. J. M. Bowling, Hughesville, Md., the presence of a true *Fusarium* wilt of tobacco.

A considerable quantity of Mammoth seed was distributed last year through the county agents and in practically all cases the growers reported excellent results. There has been a heavy demand for seed of this type, but we still need to improve the methods of obtaining seed. We have experienced no difficulty in obtaining seed by the process of stunting where the tobacco is grown where the Maryland tobacco disease does not exist. On diseased soil, however, the growth of the plants is delayed to such an extent that seed fail to ripen before frost. We are planning to continue experiments in seed growing at Marlboro during the coming season, using sterilized soil. The Maryland-Burley type also continues to give satisfactory results in the hands of many growers, but we find this type to be especially susceptible to the tobacco disease and for this reason we have never been able to obtain good yields with it at Marlboro. We have crossed the Maryland Mammoth and also the other Maryland types with Connecticut Broadleaf with the hope of breeding into these types the disease resistance of the Connecticut Broadleaf.

A set of plot tests was inaugurated last year for the purpose of studying the comparative exhausting effects of tobacco, potatoes and the grain crops.

RIDGELY SUB-STATION.

C. L. Opperman.

The Ridgely sub-station is operated with a view of supplementing the work being carried on at the home institution. With this object in view the following lines of work are in progress at the present time:

Agronomy.

1. Variety corn test plots.
2. Effect of soil on character of the corn plant.
3. Variety soybean test plots.
4. Home production of sugar corn seed.
5. Variety wheat and oat test plots.
6. Plowing versus disking corn land for wheat.

1. The variety corn test plots have been conducted for the past two years and include the testing and observation of about a dozen standard varieties of field corn. The results from this work have been

rather discouraging as the corn has been destroyed both years with the complete loss of records. Heavy storms ruined the crop of 1915 and the corn root worm killed the bulk of the young plants last season.

2. This work was started last year and consists of growing a standard variety of field corn on various types of soils. Three fields or plots are included, two at Ridgely and one at College Park. One plot is poor sandy soil capable of producing 20 to 30 bushels per acre; another is fertile sandy soil capable of producing 50 to 70 bushels per acre; and the third is fertile clay loam capable of producing about 50 bushels per acre.

3. The variety soybean test plots include the testing of about fifty varieties of these beans. This work has been progressing very nicely and data for two seasons has been procured.

4. In the home production of sugar corn seed the object is to determine whether or not the sweet corn canning sections of Maryland can produce their own seed instead of importing it at a considerable cost from the Northern States. Both home-grown and Northern seed are tested out in the plots set aside for the purpose.

5. The variety wheat and oat plots are similar to those at College Park and include the testing and comparing of ten to a dozen standard varieties of wheat. The oats have been given up for the time being on account of having been winter-killed very badly. The plots now in these grains represent the third year of the work.

6. Since the common practice is to plow corn stubble for wheat in this section, this experiment was started to determine whether or not thorough disking will answer the purpose just as well. There are four plots in this test, two being disked and two plowed.

Horticulture.

1. Variety tomato test plots.
2. Truck crop rotations.
3. Variety strawberry test plots.
4. Cultural strawberry test plots.
5. Home-grown late potato seed.
6. Experimental tomato test plots.

1. The variety test plots for tomatoes have been conducted for the past two seasons and included eight well-known standard varieties. As is the case with the variety test work, new varieties will be added from time to time as occasion may demand.

2. There are four ⅜-acre plots in the truck crop rotation experiment. This test is planned for seven years and has now been in operation for two seasons. The main idea of the work is to compare stable manure with commercial fertilizers in the growing of truck crops.

3. The variety test of strawberry plots include at present fifteen different varieties. This coming spring, however, they will be enlarged to the extent of seventy-five varieties.

4. There are five cultural plots for strawberries of ⅛-acre each. These plots are now in their second year and include the following cultural methods: Plot 1, local practice; Plot 2, lime; Plot 3, check; Plot 4, mulching; Plot 5, complete fertilizer.

5. The production of home-grown seed for late potatoes just begins to take definite form with the coming season's work. Four varieties are included, namely: McCormick, Green Mountain, Carman No. 3, and Mainistee. Various sizes of seed will be saved and planted each year and suitable notes taken on yield, etc.

6. Up to and including the present year the experimental tomato work is not conducted by any definite program. A comprehensive series of spraying tests was carried on in 1915, and in 1916 increased quantities of nitrogenous fertilizers were compared with spraying and no spraying. The coming season's work will be in the nature of spraying tests in connection with a radically different method of planting from that usually followed in this section.

Soil Fertility.

A part of this work was started last fall and the coming season will see continued activity along this line. This is the largest single piece of work at the sub-station farm and includes 140 fortieth-acre plots. As these plots are again divided by the application of lime to one-half of each plot, there will actually be 280 separate plots in this investigation.

Miscellaneous Work.

Each season thus far there has been one or more demonstration crops having no particular bearing on investigational work. For example: in 1915 there was a large field of Sudan grass and this year we have a good field of winter oats, a crop that is seldom grown in this section. In 1915 we also had two acres in cantaloupes with the object of selecting rust resistant families. In the fall of 1915 over 100 bushels of high-grade seed wheat was distributed from the sub-station farm. From now on, however, this character of work will practically cease as most of the ground is being used for definite experimental work.

Improvements During 1916-1917.

During the past fiscal year several new buildings and considerable equipment have been added to the farm. The new buildings include utility building; implement shed and chicken house. All of these structures were badly needed and their completion has materially enhanced the progress of the work. The additions to the general equipment have been in the nature of farm machinery, harness, tools, etc., which were very much needed to carry on the work in a satisfactory manner.

Quite a few repairs have been made to the dwelling houses. These include a new roof on the superintendent's house, and general minor repairs on tenant houses. All buildings, including dwellings, have been painted and are now in good condition.

During the past winter an outlet ditch for a tile drainage system for the farm has been dug and graded. The plans for completing the tile drainage system this spring have been abandoned on account of the weather, but new plans have been completed for the execution of the work next fall. All of the tile and other material needed has been purchased and is on the farm.

Seed Inspection.

C. P. Smith.

The work of the Seed Inspection Laboratory for the year ending January 30th, 1917, may be briefly summarized as follows:

Unofficial Samples. Nearly 700 samples were received from citizens of the State and analyzed, largely for both purity and germination. The following table shows the number of such samples by months, for five consecutive years.

	1913	1914	1915	1916	1917	
January	12	11	29	56	77	Number of Samples
February	12	37	51	84	86	" " "
March	5	51	62	117	96	" " "
April	2	32	90	27	45	" " "
May	2	15	60	42	61	" " "
June	3	12	13	27	32	" " "
July	1	34	18	50		" " "
August	25	40	11	58		" " "
September	12	31	20	118		" " "
October	11	11	11	16		" " "
November	20	20	13	15		" " "
December	2	12	12	34		" " "

Inspections and Official Samples.

The activities along this line may be best summed up in the following table:

Trips	Dates	Dealers* Visited	Samples Taken
Laurel-Baltimore City	Aug. 11–12, 1916	9	23
Eastern Shore	15–26	85	183
Baltimore City	Sept. 8	4	35
Carroll-Frederick**	13–16	30	58
Frederick**	18–21	14	12
Carroll-Montgomery	26–28	24	52
Montgomery-Allegany	20–23	43	69
Baltimore City	Feb. 20 1917	4	33
Baltimore City	22	2	45
Montgomery	Mar. 7	10	12
Eastern Shore	7–17	74	333
Frederick-Carroll	15–16	21	42
Carroll	21–22	11	37
Rockville	23	3	16
Cecil-Kent	21–23	17	42
Baltimore City	24	2	15
Annapolis-Belair	29–30	13	26
Laurel	31	2	10
Frederick	29–31	25	57
Washington-Garrett	Apr. 9–15	56	156
Baltimore City	May 23	2	51
Baltimore City	May 29	2	43
Baltimore City	June 11	3	32

**County.

*Includes railroad station and wharves.

Biological Laboratory.

F. T. Kocher.

The work of the biological laboratory was interrupted by the transfer of Dr. S. S. Buckley to the Extension Service. The vacancy caused by this transfer was not filled at once on account of the contemplated reorganization of the animal husbandry work. On January 1st the work was provided for by the temporary appointment of Dr. F. T. Kocher. He was asked to continue in the work, but resigned to take up the practice of his profession. The following statement represents the activities of the laboratory from January 1st to April 30th:

In connection with the production of hog cholera anti-serum we have used the following pigs, all under 50 pounds in weight:

Pigs inoculated to produce virus	42
Virus pigs not reacting	4
Virus pigs inoculated (not killed)	6
Total virus pigs killed	32
Virus produced	14,660 c. c.
Pigs used to test hog cholera anti-serum	12

Results of this test cannot be reported until a later date.

Pigs treated to be used as hypers:	
Pigs given simultaneous treatment	32
Pigs given virus alone (of above)	16
Pigs hypered	6
Pigs rehypered	3
Hypers bled eight times	1
Hypers bled four times	4
Hog cholera anti-serum on test (S. 1)	14,000 c. c.
Hog cholera anti-serum bled in first four bleedings of above four pigs (on hand)	23,400 c. c.

From January 1 to April 14, 1917, inclusive, hog cholera anti-serum delivered to be used in the State	42,700 c. c.
Virus used in the State	168 c. c.

There were two pigs sent to the laboratory for post-mortem on which the findings were:

One was hog cholera.
One was tuberculosis.

Both parties were advised according to Maryland State Board of Agriculture rulings.

In addition to these, there were 15 cases needing veterinary treatment and they were diagnosed and treatment given or advised. Considerable work was done in an effort to produce clear, sterile hog cholera anti-serum. The results were gratifying and promising, but time did not permit the completion of the tests as to potency.

FINANCES.

The following report of the Treasurer shows the details of the expenditures for the past fiscal year:

MARYLAND AGRICULTURAL EXPERIMENT STATION.

In Account with

UNITED STATES APPROPRIATIONS.

DR.	Hatch Fund	Adams Fund
To appropriations for fiscal year 1916-17	$15,000.00	$14,472.49
Balance June 30, 1916		527.51
Total		$15,000.00
DR.		
By Salaries	$11,399.49	$10,950.78
Labor	1,041.88	424.30
Postage and Stationery	7.63	1.87
Publications	1,119.26	....
Freight and Express	9.50	....
Heat, Light, Water and Power	263.05	233.94
Chemicals and Laboratory Supplies	321.29	1,181.57
Seeds, Plants and Sundry Supplies	108.37	503.20
Library	23.94	....
Tools, Implements and Machinery	12.04	91.64
Furniture and Fixtures	37.28	112.33
Scientific Apparatus	582.89	1,297.32
Live Stock	....	80.00
Traveling Expenses	4.20	12.62
Buildings and Land	69.18	110.43
Totals	$15,000.00	$15,000.00

The above is a true copy.

H. T. HARRISON, *Accountant.*

MARYLAND STATE BOARD OF AGRICULTURE.

In Account with

THE SEED INSPECTION FUND.

DR.	
Balance June 30, 1916	$520.11
Receipts for Year	6,875.00
Total	$7,395.11
CR.	
Salaries	$3,126.61
Labor	307.75
Travel	201.44
Scientific Apparatus	151.37
Postage and Stationery	285.31
Publications	857.82

Supplies	79.98
Furniture and Fixtures	46.95
Chemicals	17.26
Library	5.00
Balance June 30, 1917	2,315.62
Total	$7,395.11

The above is a true copy.

H. T. Harrison, *Accountant.*

MARYLAND AGRICULTURAL EXPERIMENT STATION.

In Account with

The State Appropriations.

DR.	General Fund	Hort'l Fund	Ridgely Farm
Balance June 30, 1916	$216.01	$1,293.83	$195.14
State Appropriation	25,000.00	3,000.00	5,375.00
Interest	47.65	44.76	....
Sale of Produce	....	....	642.67
Totals	$25,263.66	$4,338.59	$6,212.81

CR.	General Fund	Hort'l Fund	Ridgely Farm
Fertilizer	....	$779.95	$128.10
Salaries	$4,623.14	605.50	1,700.00
Labor	3,753.25	522.04	784.46
Feeding Stuffs	2,411.34	....	116.78
Traveling Expenses	273.02	64.46	29.88
Scientific Apparatus	241.61	60.96	....
Postage and Stationery	685.62	177.32	26.82
Publications	872.52	221.84	....
Contingent Expenses	3,777.68	289.46	508.00
Buildings and Repairs	724.66	....	1,473.37
Heat, Light and Water	312.71	555.71	....
Furniture and Fixtures	636.19	51.70	....
Chemicals	256.14	144.17	....
Library	185.46	224.30	....
Seeds, Plants and Sundry Supplies	1,925.73	414.48	221.87
Freight and Express	384.76	112.28	43.70
Tools, Implements and Machinery	1,844.12	100.44	180.45
Live Stock	846.25	....	350.00
Drainage and Irrigation	....	....	243.34
Balance June 30, 1917	1,509.46	13.98	406.04
Totals	$25,263.66	$4,338.59	$6,212.81

The above is a true copy.

H. T. Harrison, *Accountant.*

MARYLAND AGRICULTURAL EXPERIMENT STATION.

In Account with

DR.	Farm Sales	Biol. Lab.
Receipts for Year	$12,207.87	$8,098.27
Balance June 30, 1916		1,754.83
Total		$9,853.10
CR.		
Fertilizers	$895.34	....
Salaries	52.00	$2,417.47
Labor	8,687.20	293.00
Traveling	56.85	....
Scientific Apparatus	38.25	63.86
Postage and Stationery	2.97	110.18
Contingent Expenses	....	765.35
Buildings and Repairs	....	186.65
Heat, Light and Water	465.99	7.74
Furniture and Fixtures	....	55.02
Chemicals	....	27.50
Library	....	2.00
Seeds, Plants and Sundry Supplies	121.45	1,598.23
Freight and Express	124.62	14.60
Tools, Implements and Machinery	50.06	17.95
Live Stock	81.00	474.14
Feeding Stuffs	....	473.20
Telephones and Telegraph	....	7.88
Deficit June 30, 1916	226.98	....
Balance June 30, 1917	1,405.16	3,338.33
Totals	$12,207.87	$9,853.10

The above is a true copy.

H. T. Harrison, *Accountant.*

ate

MARYLAND & RARE BOOK ROOM
UNIVERSITY OF MARYLAND LIBRARY
COLLEGE PARK, MD.

DO NOT CIRCULATE

630.75
M36
4th set
1916/17-25/26

162385

DO [redacted] CIRCULATE